Ministry of
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Ontario

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EVALUATION OF GRE-LIN ROAD BINDER DUST PALLIATIVE

MATERIALS INFORMATION
ENGINEERING MATERIALS OFFICE

EVALUATION OF GRE-LIN ROAD BINDER

DUST PALLIATIVE

by

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Bituminous Section

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EVALUATION OF GRE-LIN ROAD BINDER
DUST PALLIATIVE

1. INTRODUCTION

The Bituminous Section was requested by the Ministry's Burlington District Office to investigate the dust suppressant capability of Gre-Lin Road Binder. Gre-Lin Road Binder is a lignosulphonate produced by Domtar Packaging (Kraft Paper and Board Division) in Trenton, Ontario, by pressing the wood chips after cooking with water and sodium carbonate. The Road Binder is a water solution of both the spent cooking chemical and the organic material dissolved out of the wood during the cooking process.

The Road Binder was transported from Trenton by Gre-Lin Enterprises of Hannon, Ontario, to the Township of West Lincoln in the Smithville area. Approximately 272,700 L were used in the Township during the months of May and June, 1986.

This report is an evaluation of the performance of the lignosulphonate dust palliative "Gre-Lin Road Binder".

1.1 Guidelines for Dust Pallative Trials

The Ministry requires that field trials on Ministry roads of new products be placed adjacent to calcium chloride or waste oil so that performance comparisons can be made. This requirement was not met, however, the Ministry proceeded with the evaluation because of prior experience with a lignosulphonate.

2. APPLICATION

2.1 Dilution Procedure

The lignosulphonate from the cooking process is concentrated to about 32% solids in an evaporator and transferred to a holding pond. Precipitation dilutes the lignosulphonate so that the relative density at 25°C varies from 1.061 to 1.082 and the percent solids (by mass) ranges from 16 to 20.

The Gre-Lin Road Binder was pumped as is from the holding pond to the tanker and transported to the job site. The Road Binder was not mixed with water and was sprayed, after circulation, at ambient temperatures on arrival at the job site.

A sample taken by Mr. McFeeters of Gre-Lin Enterprises on 86 05 23 had a relative density at 25°C of 1.076[1] with an approximate solids content of 19% (by mass).

2.2 Spraying Equipment

Two 18,000 L transport tankers were modified by the addition of a 2.4 m spray bar at the rear. The spray bars were pressurized by small pumps. The Road Binder could be circulated by placing a return line in the top of the tanker. The tankers were not equipped with dip sticks or pump output gauges to regulate the application rates.

2.3 Preparation of the Granular Grade

The limestone granular grades, which are common in the Township, were graded to remove potholes and were shaped for cross-section and ride. Many of the roads had loose float on the surface prior to the application of the Road Binder. Typically the granular base material contained 10 to 15% passing the 75 µm sieve.

(1) MTC test result 86 05 23.

2.4 Application of Gre-Lin Road Binder

The Road Binder was applied at 17 sites in the Townsip of West Lincoln. The following information about spraying was obtained from Mr. E. Griffin, road superintendent of West Lincoln and Mr. H. McFeeters of Gre-Lin Enterprises.

The Gre-Lin Road Binder was applied at various times between 86 05 11 and 86 06 15. The Road Binder was sprayed at application rates ranging from a low of 0.8 L/m^2 to a high of 4.8 L/m^2, see Table 2. All were single applications except for Road 3, which had had two applications in the same day. The average application rate was 1.65 L/m^2 for the 17 roads. When Road 3, which had an unusually high rate, was excluded the average application rate was 1.45 L/m^2

The Road Binder did not track, pick-up or splash onto passing vehicles after application. The Township did not receive complaints from motorists about the newly applied Road Binder.

3. PERFORMANCE

3.1 General

Granular grades sprayed with Gre-Lin Road Binder, when dry, produced smooth, hard, stabilized roads that were brownish in colour. Traffic gradually began to dislodge aggregate particles, both small and large, until the stabilized surface was lost. Dust and potholes gradually increased over a period of one to four months.

3.2 Rating System

A visual rating system was used to evaluate the dust control performance and the potholing frequency. Dust generated by a car travelling at 80 km/h was observed and rated on a scale of 1 to 10. A rating of 1 indicated extremely dusty conditions with very poor visibility and a dust cloud rising over 3 m. No dust at all was rated at a perfect 10. The potholing was observed and rated as 1 for continuous, 4 for moderate, 7 for occasional and 10 for none. A rating form can be found in the appendix.

3.3 Performance Ratings

Six roads were inspected and rated on 86 07 15 approximately one and a half months after the application of the Road Binder. See Table 1.

South Grimsby Road 3 (78 AADT)

South Grimsby Road 3 had received a heavy application (4.8 L/m^2) of Road Binder. There was light dust and very few potholes under light traffic conditions.

South Grimsby Road 18 (653 and 433 AADT)

South Grimsby Road 18, north and south of Hwy. 20, received light applications (0.8 L/m^2) of Road Binder on 86 05 11 and 13. Dust and potholing were rated as moderate after one month under higher traffic conditions.

South Grimbsy Road 21 (60 and 90 AADT)

South Grimsby Road 21, south and north of Hwy. 20, received light applications (0.8 L/m^2) of Gre-Lin Road Binder and were rated moderate for dust and potholing under light traffic conditions.

Table 1 PERFORMANCE RATINGS OF GRE-LIN ROAD BINDER (1)

Road	Location	Dust Control Rating (2)	Pothole Rating (3)	Appliction Rate, L/m2	Traffic AADT
South Grimsby Road 3	North of Hwy 20	6	8	4.8	78
South Grimsby Road 18	South of Hwy 20	5	4	0.8	653
South Grimsby Road 18	South of Hwy 20	6	5	0.8	433
South Grimsby Road 21	North of Hwy 20	5	6	0.8	60
South Grimsby Road 21	West of Grassie	5	5	0.8	99
Young St	West of Grassie	7	7	2.1	78

Notes:
(1) Rated on 86 07 15.
(2) Visual dust ratings: 10 none, 7 light, 4 moderate, 1 heavy.
(3) Visual pothole ratings: 10 none, 7 occasional, 4 moderate, 1 continous.

Table 2 GRE-LIN ROAD BINDER OVERALL PERFORMANCE

Road	Location	Length of Dust Control, Months	Date of First Grading	Application Rate L/m2 (4)	Traffic Volume AADT
South Grimsby Rd 3	-	4	Note (1)	4.8	78
Concession 7	Road 10 to 14	4	Note (1)	0.9	47
Concession 7	Road 15 to 17	4	Note (1)	1.7	47
Road 10	Mud St to Young St	4	Note (1)	1.5	97
Road 10	Young St to Hwy 20	4	Note (1)	1.7	29
Road 11	-	1	86 07 02(2)	1.9	24
Road 12	Mud St to Conc 7	4	Note (1)	1.5	50
Road 14	Mud St to Conc 7	4	Note (1)	1.7	72
Road 17	Mud St to Conc 7	4	Note (1)	1.7	78
South Grimsby Rd 18	North of Hwy 20	3	86 08 26(2)	0.8	653
South Grimsby Rd 18	South of Hwy 20	3	86 08 26(2)	0.8	433
Road 19	South of Hwy 20	4	Note (1)	1.7	15
Road 20	North & South Hwy 20	4	Note (1)	1.7	28
South Grimsby Road 21	South of Hwy 20	4	Note (1)	0.8	60
South Grimsby Road 21	North of Hwy 20	4	Note (1)	0.8	99
Young St	West of Grassie	4	Note (1)	2.1	78
Young St	East of Grassie	1(3)	86 07 02(2)	1.9	118

Notes:
(1) Week of 86 09 22.
(2) An application of liquid calcium chloride was placed over the Gre-Lin Road Binder on these dates.
(3) Only the eastbound lane was treated with Gre-Lin Road Binder
(4) Average application rate: 1.65 L/m2; 1.45 L/m2 excluding 4.8 L/m2 on Road 3.

Young St. (78 AADT)

Young St., west of Grassie Road, received a heavy application (2.1 L/m^2) of Road Binder and showed light dust and occasional potholing under light traffic conditions.

3.4 Overall Performance

Seventeen roads (see Table 2) were treated with the Gre-Lin Road Binder and except for four roads, the treatment lasted almost four months. Dust and the pothole frequency were controlled satisfactorily until the week of September 22nd, 1986 when the 13 roads were graded. The roads were dusty and rough at this time.

The four roads where the Road Binder did not last four months were Road 11, South Grimsby Road 18, north and south of Hwy. 20 and Young Street east of Grassie Road.

Road 11 (24 AADT)

Mr. Grffin received complaints about the dust from Road 11, one month after the application of the Road Binder. Road 11 was graded and treated with liquid calcium chloride on 86 07 02.

South Grimsby Road 18 (653 and 433)

The Road Binder on South Grimsby Road 18, north and south of Hwy. 20, lasted three and one half months. At this time, the road was dusty and rough. Both sections of Road 18 were graded and treated with liquid calcium chloride on 86 08 26. The performance of the Road Binder was considered satsifactory over the three month period considering the higher traffic volumes. A second application of Road Binder or liquid calcium chloride is generally warranted under these traffic volumes.

Young Street East of Grassie Road (118 AADT)

Young Street, east of Grassie, did not receive an application of dust palliative in the westbound lane; an application of Road Binder was only made in the eastbound lane. Young Street was graded and treated with liquid calcium chloride on 86 07 02.

3.5 Township Comments

Mr. E. Griffin, the road superintendent of the Township of West Lincoln made the following comments:

> "... experienced more potholes with calcium chloride than with the Gre-Lin Road Binder."
>
> "... the Gre-Lin Road Binder did a reasonable job."
>
> "... The Gre-Lin Road Binder held well with light traffic."
>
> (less than 200 AADT).
>
> "The Gre-Lin Road Binder is not recommended for roads in the 200 to 500 AADT range."

Mr. Griffin felt that liquid calcium chloride was more effective on roads with traffic counts of 200 to 500 AADT. He is planning to use liquid calcium chloride in 1987 because of the lower cost, the effectiveness and fewer environmental concerns as described in Section 4.

3.6 Precipitation

The total monthly precipitation was obtained from the Environment Canada Ridgeville weather station. Ridgeville is located 27 km east of Smithville and is the closest weather station to the Township.

Table 3 shows the total monthly precipitation for the months of June, July, August and September. The average precipitation for these months was 106.7 mm in 1986 compared to 73.2 mm for the 30 year average. This represents a 46% increase in precipitation over the 30 year average. Rain causes small amounts of Road Binder to be washed from the road, reducing the dust palliative effect.

Table 3 TOTAL MONTHLY PRECIPITION, mm (1)

Month	1986	30 Year Average
June	87.8	71.2
July	114.4	53.7
August	91.5	83.5
September	133	84.3

Note:
(1) Environment Canada Ridgeville weather station.

4 ENVIRONMENTAL CONCERNS

The Road Binder has been used for many years in the Counties and Townships near Trenton. The Ministry of the Environment permits the use of lignosulphonates provided that precautions are taken near streams and wells. The Ministry of the Environment is currently carrying out toxicity studies for humans and aquatic life.

Care must be taken to avoid direct runoff into ditches. A maximum single application rate of 1.5 L/m^2 and the total multiple application rate of 2.6 L/m^2 has been established by the Ministry of the Environment(2). The Gre-Lin Road Binder should not be applied during a rain, near wells, streams or bodies of water.

(2) Aquin, Korgemagi and Lynch, 1986, Evaluation of Tembind 35 Dust Palliative.

The Township of West Lincoln was required to send a copy of the manifest accompanying each load to the local Ministry of the Environment office.

5. COST COMPARISON

The cost to supply and apply the Gre-Lin Boad Binder was 14.4 cents per square metre. Liquid calcium chloride had cost 7.1 cents per square metre to supply and apply. The Gre-Lin Road Binder was twice as expensive as liquid calcium chloride when used at the Township application rates.

Table 4 COST COMPARISION AT TOWNSHIP RATES

	Cost Per m2, Cents	Township Rate,L/m2	Cost Per L, Cents
Gre-Lin Road Binder	14.35	1.45 (1)	9.899 (3)
Liquid Calcium Chloride	7.05	0.51 (2)	13.814 (3)

Notes:
(1) Average application rate excluding Road 3, from Table 3.
(2) Based on 6 Imperial tons of liquid calcium chloride per mile by 16 feet wide.
(3) Does not include ORST.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

1. A direct comparison of the performance of the Gre-Lin Road Binder with liquid calcium chloride was not made because calcium chloride was not placed adjacent to the Road Binder.

2. The percent solids of the Gre-Lin Road Binder ranges from 16 to 20. This is much less than the 27.5 % solids of other lignosulphonates.
3. Spraying predetermined rates of Road Binder may be difficult because the spraying units were not equipped with dipsticks or pump output gauges.
4. The Gre-Lin Road Binder was applied only on crushed limestone granular bases with 10 to 15% passing the 75 µm sieve. Ideal performance of the Road Binder may decline on cleaner crushed gravel granular bases.
5. The average application of 1.45 L/m^2 was higher than required. South Grimsby Road 18 performed satisfactorily at a rate of 0.8 L/m^2 over a period of three months. The rates for lignosulphonates recommended by RTAC are 0.9 to 1.1 L/m^2 for the inital application and 0.7 to 0.9 L/m^2 on the subsequent application when the traffic volumes are less than 100 ADT (3).
6. The Gre-Lin Road Binder controlled dust and potholing satisfactorily for approximately four months on 13 out of 17 roads.
7. The Township rated liquid calcium chloride higher in performance than the Gre-Lin Road Binder because of lower cost, greater effectiveness and fewer environmental concerns, such as notifying the MOE.
8. The Gre-Lin Road Binder controlled dust and potholing satisfactorily during a wet summer when lignosulphonates are generally less effective.

(3) RTAC, 1987, Guidelines for Cost Effective Use and Application of Dust Palliatives.

6.2 Recommendations

1. The Gre-Lin Road Binder should be applied at not less than 25% solids (by mass).
2. The spraying equipment should capable of distributing specified rates.
3. The Gre-Lin Road Binder should be accepted as an alternative to calcium chloride and subsidy should be provided to Municipalities. This recommendation is based on a single application rate of 0.9 to 1.5 L/m^2 at 25 to 27% solids.

7. ACKNOWLEDGEMENT

The authours extend their thanks to Mr. E. Griffin, the road superintendent of the Township of West Lincoln, for the time and assistance given to prepare this report.

Ontario

(Tel.#416-527-9133/637-5625)

Ministry of
Transportation and
Communications

1986 01 17

MEMORANDUM TO:

D. F. Lynch
Head, Bituminous Section
3rd Floor, Central Building
DOWNSVIEW

Attention: Ray Acquin

SUBJECT: Domtar Black Liquor
Used as Road Binder
on Township Roads.

January 15th we met with Mr. Hugh McFeters, a gentleman in the trucking business, who advised that he has been approached by Domtar Packaging Kraft Paper and Board Division (Trenton) to haul and apply Domtar Road Binder to gravel roads and other gravel surfaces in the vicinity of Domtar's plant. Apparently in past years Domtar has been supplying this material to local municipalities for free, provided that the municipalities supply or hire the necessary tanker(s) and application equipment and pick up the material at Domtar's plant. I have attached literature obtained from Mr. McFeters on this product.

Mr. McFeter's lives near Hamilton and indicated that he has been approached by West Lincoln Township to try some of the Domtar material on West Lincoln's gravel roads.

We advised Mr. McFeters that if we were approached by a municipality, we would agree to a test of this material to compare its dust laying ability with that of calcium chloride or waste oil.

In subsequent discussion with Ed Griffin, West Lincoln Road Superintendent, I advised Ed that this test application would be eligible for subsidy provided that a proper comparison was provided to the normal dust palliative used by West Lincoln (calcium chloride). I also asked Ed to insure that he is provided by Mr. McFeters or Domtar, with a statement from M.O.E. regarding environmental acceptability of this material when applied as a dust layer, together with an indication of application rates and frequency. This appears to be a product with some potential, provided that the cost of hauling is reasonable.

...../2

Ray, when we are formally approached by the Township, we will request your assistance in setting up a comparative test of this product.

G. Norman
District Municipal Engineer
District #4, Burlington

GN:kt

Attachments

c.c. H. Orlando
A. McKillop

FOLLOW-UP DUST PALLIATIVE INSPECTIONS

Road _____

Municipality _____

Rating - Dust(1): 10 None, 7 Light, 4 Moderate, 1 Heavy(2).

Potholing: 10 None, 7 Occasional, 4 Moderate, 1 Continuous.

INSPECTION DATE: _____

	New Product	Comparative Product
No. of Times Graded	_____	_____
Date of Last Grading	_____	_____
Dust From Car Travelling at 80 km/h	10 9 8 7 6 5 4 3 2 1	10 9 8 7 6 5 4 3 2 1
Potholing	10 9 8 7 6 5 4 3 2 1	10 9 8 7 6 5 4 3 2 1

INSPECTION DATE: _____

	New Product	Comparative Product
No. of Times Graded	_____	_____
Date of Last Grading	_____	_____
Dust From Car Travelling at 80 km/h	10 9 8 7 6 5 4 3 2 1	10 9 8 7 6 5 4 3 2 1
Potholing	10 9 8 7 6 5 4 3 2 1	10 9 8 7 6 5 4 3 2 1

Notes: (1) Dust rating must be carried out when this road surface is dry.
(2) Extremely dusty, very poor visibility, dust cloud rising over 3 m.

86 03 20